

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application:

Listing of claims:

1. (CURRENTLY AMENDED) A method for forming a photoresist pattern on a prescribed film, said photoresist pattern having a multi-level profile formed from exposure to light transmitted through a reticle having a multi-level profile, ~~wherein the reticle includes one or more films overlying the reticle substrate to partially transmit and shift the phase of incident light;~~
~~the reticle substrate passing all incident light and~~
~~the partially transmitting phase shift film transmitting approximately 20% to 70% of incident light and shifting the phase about 180 degrees in transmission through the partially transmitting film, and~~
~~an opaque film overlying sections of the partially transmitting film, the opaque film blocking light so that all incident light is attenuated,~~
the method comprising the steps of:
providing a reticle; the reticle comprises one or more films overlying a reticle substrate to partially transmit and shift the phase of incident light,
the reticle substrate passing essentially all incident light and
the partially transmitting phase shift film transmitting approximately between 20% to 70% of incident light and shifting the phase about 180 degrees in transmission through the partially transmitting film, and
an opaque film overlying sections of the partially transmitting film, the opaque film blocking light so that essentially all incident light is attenuated;
 - a) exposing a light sensitive photoresist film, having a predetermined thickness, to light transmitted through the reticle for a predetermined amount of time,

with light being transmitted through the reticle substrate exposing a first photoresist area to a first dosage,

with light being transmitted through the partially transmitting film exposing a second photoresist area to a second[[,]] intermediate dosage, and

with light being transmitted through the remaining opaque film exposing a third photoresist area to a third dosage;

said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less or more sensitive to light than said upper photoresist layer;

and

b) developing the photoresist film exposed in step (a) to form a photoresist profile having an opening in the first photoresist area,

the photoresist profile having the photoresist predetermined thickness in the third photoresist area, and the photoresist profile having an intermediate thickness, between the predetermined thickness and zero, in the second photoresist area[[,]] .

~~whereby light introduced to the reticle transmits at least three intensities of light to transform the photoresist substrate into a profile of at least two thicknesses and an opening.~~

2. (CANCELED)

3. (CURRENTLY AMENDED) The method of claim 1 wherein ~~said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer;~~ said lower photoresist layer is less sensitive to light than said upper photoresist layer between about 5 and 10%.

4. (CURRENTLY AMENDED) The method of claim 1 wherein ~~said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer;~~ said lower photoresist layer is less sensitive to light than said upper photoresist layer in a case where the layers are positive type or

said lower photoresist layer is more sensitive to light than said upper photoresist layer in a case where the photoresist layers are negative type.

5. (PREVIOUSLY PRESENTED) The method of claim 1, which further includes etching in a single step, said photoresist film and a dielectric layer under said photoresist film to form a dual damascene shaped opening in said dielectric layer;

said photoresist film and said dielectric layer have about the same etch rate.

6. (CURRENTLY AMENDED) A method of forming a photoresist profile ~~on~~ over a substrate using a reticle ~~having a multi-level profile including~~
____ (1) a transparent substrate,
____ (2) a partially transmitting 180 degree phase shift film overlying
~~predetermined areas of the transparent substrate to transmit approximately 20 to 70% of incident light, and~~
____ (3) an opaque film overlying the predetermined areas of the partially
transmitting 180 degree phase shift film,

the method comprising the following steps:

providing a reticle; said reticle having a multi-level profile comprising
____ (1) a transparent substrate,
____ (2) a partially transmitting 180 degree phase shift film overlying
predetermined areas of the transparent substrate to transmit approximately 20 to 70%
of incident light, and

(3) an opaque film overlying the predetermined areas of the partially transmitting 180 degree phase shift film,

a) depositing a photoresist film having a predetermined thickness over a dielectric layer over on the substrate; said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer;

b) in a one step exposure, directing light to the photoresist film through the reticle, the reticle transmitting a first intensity through the transparent substrate to create a first exposure pattern,

the reticle transmitting a second intensity, less than the first intensity, through the partially transmitting 180 degree phase shift film to create a second exposure pattern, and

the reticle transmitting a third intensity, blocking about all incident light, through the opaque film to create a third exposure pattern; and

c) developing the photoresist film to remove a first thickness of photoresist film, approximately equal to the predetermined thickness, in areas of the first exposure pattern, and

to remove a second, intermediate thickness of the photoresist film, less than the first thickness, in the areas of the second exposure pattern, whereby the profile includes areas of photoresist film having a plurality of different thicknesses.

7. (CANCELED)

8. (CURRENTLY AMENDED) The method of claim 6 wherein ~~said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer;~~

the sensitivity of the lower photoresist layer and the upper photoresist layer is adjusted so that:

* the first intensity of light through the transparent substrate sensitizes both the lower and upper photoresist layers; and

* the second intensity of light through the transparent substrate sensitizes only the upper photoresist layer; and

* the third intensity of light through the opaque film does not sensitize the lower or the upper photoresist layer.

10. (CURRENTLY AMENDED) The method of claim 6 which further includes: said photoresist film is comprised of a lower photoresist layer and an upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer; said lower photoresist layer is less sensitive to light than said upper photoresist layer by between about 5 and 10%; and

transferring said pattern in said photoresist film by an etch into the surface of said substrate in a single etch step; the etch rate of said photoresist film and said dielectric layer ~~substrate~~ are about equal.

11. (CANCELED)

12. (CURRENTLY AMENDED) A reticle through which at least three intensities of incident light are passed to define a multi-level profile on a light sensitive photoresist surface, the reticle comprising:

- a) a first transmission level film producing transmitted light of a first intensity;
- b) a second transmission level film producing transmitted light of a second, intermediate, intensity less than the first intensity, transmitting between approximately 20% and 70% of incident light; and
retarding the phase of the transmitted second intensity of light approximately 180 degrees; and

- c) a third transmission level film producing transmitted light of a third intensity less than the second intensity, whereby the light transmitted through the reticle with the first intensity exposes a first photoresist area to a first dosage, the light transmitted with the second intensity exposes a second photoresist area to a second

dosage, and the light transmitted with the third intensity exposes
a third photoresist area to a third dosage;

said first transmission level film is a substrate, in which said second transmission film overlies said substrate, and in which said third transmission level film overlies said second transmission level film;

said third transmission level film has a third transmission level opening, through said third transmission level film, to reveal a predetermined area of said second transmission level film, and in which said second transmission level area has a second transmission level opening, through said second transmission level, to reveal a predetermined area of said first transmission level film.

13. (CANCELED)

14. (CURRENTLY AMENDED) The reticle as in claim 12 in which said third transmission level film is an opaque film comprised of a material selected from a group consisting of Cr, CrO, and iron oxide, whereby said third transmission level film blocks incident light;

said second transmission level film is comprised of a material selected from the group consisting of indium tin oxide, elemental metal, molybdenum silicon oxynitride, gold, chromium fluoride, zirconium silicon oxide, molybdenum silicon oxide, aluminum nitride, or silicon nitride.

15. (ORIGINAL) The reticle as in claim 12 in which said first transmission level film is selected from a group consisting of quartz, synthetic quartz, and glass, whereby said first transmission level film is transparent to pass all incident light.

16. (CANCELED)

17. (CURRENTLY AMENDED) A reticle for transmitting at least three intensities of incident light to create a multi-level profile pattern of at least three thicknesses on a light sensitive photoresist film overlying an integrated circuit interlevel dielectric, the reticle comprising:

a transparent substrate, said transparent substrate passing essentially all incident light to form a first thickness of photoresist profile less than the first thickness of photoresist film,

a partially transmitting film, said partially transmitting film retarding the phase of incident light approximately 180 degrees and transmitting between approximately 20% and 70% of incident light to form a second thickness of photoresist profile; the second thickness greater than the first thickness of photoresist film;

an opaque film, said opaque film blocking essentially all incident light to form a third thickness of photoresist film greater than the second thickness of photoresist film.

18. (ORIGINAL) The reticle as in claim 17 in which the first thickness is substantially zero so that an opening is formed in the photoresist film.

19. (CURRENTLY AMENDED) A photolithographic reticle to form a dual damascene profile in a photoresist film having a third thickness, the dual damascene profile having a via at a first thickness of zero and a trench at a second thickness, intermediate between the first and the third thicknesses, from a single exposure to a light source, the reticle comprising:

a transparent substrate, said substrate passing all incident light to form the first thickness of photoresist profile,

a partially transmitting phase shift film, said partially transmitting phase shift film retarding the phase of incident light approximately 180 degrees and intermediately attenuating incident light to form the second thickness in the photoresist profile; said partially transmitting phase shift film transmits more than approximately

20%, but less than approximately 70% of incident light;

an opaque film, said opaque blocking all incident light to form the third thickness in the photoresist profile.

20. (CANCELED)

21. (PREVIOUSLY PRESENTED) The method of claim 1 which further includes said light sensitive photoresist film is comprised of a lower photoresist layer and an upper photoresist layer;
etching in a single step, said light sensitive photoresist film and a dielectric layer under said light sensitive photoresist film to form a dual damascene shaped opening in said dielectric layer;

said lower photoresist layer, said upper photoresist layer and said dielectric layer have about the same etch rate.